Evaluation, analysis and perception of Sustainable Forest Management through the lens of the PEFC forest certification using two case studies in Sicily

E. LOMBARDO [a] and F.G. MAETZKE [a]

[a] *Department of Agricultural, Food and Forest Sciences, University of Palermo, Italy*

Email: emanuela.lombardo@unipa.it, federico.maetzke@unipa.it

SUMMARY

Sustainability of forest management nowadays reached a common understanding between scientific and technical definition, a series of criteria and indicators have been implemented for monitoring the effectiveness of the management in functional and structural terms, and to evaluate its effects on ecosystem services of forests. Currently, Sicily has no forest areas with certification of sustainable forest management. In order to evaluate the diffusion of knowledge of certification schemes and their importance in SFM, a questionnaire survey was carried out during a foresters' workshop. Considering that PEFC certification could be applied to Sicilian forest context, in this paper the possibility of applying the criteria and indicators of PEFC certification of sustainable forest management is analyzed in two case studies, representative of Sicilian forest ecosystems. This analysis highlights the main weaknesses related to current management practices and inadequate consultation with stakeholders. Some critical aspects of the certification process are discussed, enlightening possibilities and difficulties.

The information given in this paper have been presented in a preliminary Italian form and language in the Italian Review "L'Italia Forestale e Montana" n. 72 - 6/2017

Keywords: PEFC certification; forest management; standard; sustainability; Sicily Region

INTRODUCTION

At the end of the twentieth century, a new approach has been adopted to protect forest ecosystems from degradation and deforestation and to diffuse a forest management system based on principles of sustainability, (Paletto and Notaro, 2018; Faggin *et al.* 2017). In fact, since the mid-1980s,

promoting Sustainable Forest Management (SFM) has been a central concern of forest governance globally, (Tricallotis *et al.* 2018).

Starting from the United Nations Conference on Environment and Development in Rio de Janeiro (1992) and several Ministerial Conferences on the Protection of Forests in Europe (MCPFE) the SFM has been conceptualized. During the 2nd Ministerial Conference held in Helsinki (MCPFE, 1993), SFM was defined as: *"the stewardship and use of forests and forest land in the forms and at a rate of use that maintains their biodiversity, productivity, regeneration capacity, vitality and potential to fulfill now and in the future relevant ecological, economic and social functions at local, national and global levels, and that does not damage to other ecosystems* "(Resolution H1, D). SFM fosters the socio-economic development matched with the need for environmental protection, (Mladenoff and Pastor 1993). It includes all forest values: social, environmental, cultural and spiritual, (Rametsteiner and Simula, 2003). The concept provides guidance on how to manage forests to provide for today's needs (as best as possible) and not compromise (i.e reduce) the options of future generations, (MacDicken *et al*. 2015).

A significant number of regulating systems and tools have been developed that aim to address the increasing interest in promoting sustainable forest management, (Halalisan *et al.* 2018, Vizzarri *et al*. 2017). They also include inventories, monitoring, forest management certification, stakeholder involvement, and forest management plans, (MacDicken *et al.* 2015).

In order to evaluate the SFM and to achieve a common understanding of its scientific definition, a series of criteria and indicators have been implemented for monitoring the effectiveness of the management in functional and structural terms, and to evaluate its effects on ecosystem services provided by forests (Mendoza and Prabhu 2005). Criteria and Indicators (hereafter C & I) were developed in the '90s following the Montreal Process on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests (1995), the Intergovernmental Panel on Forests of the United Nations (1995) and the Intergovernmental Forum on Forests for the implementation of Agenda 21, "1997", (Wang and Wilson 2007). During the 3rd MCPFE (Lisbon 1998), a set of 6 criteria and 35 quantitative, as well as 17 additional qualitative indicators, (Baycheva-Merger and Wolfslehner, 2015) were identified to evaluate the results of forest management: today those set can be considered a reference point for sustainable forest management in Europe (Paletto *et al.* 2014). Since the first set of Pan-European Indicators for SFM in 1998 and its improvement in 2003 (MCPFE in Vienna), experience has shown that criteria and indicators are a very important tool for European forest policy, (Forest Europe 2015). In fact, the criteria and indicators constitute a valid tool at the base of the "State of Europe's Forests" report.

This report offers a comprehensive overview of trends and policy responses related to European forests, as well as an insight into sustainable forest management (SFM) in Europe, (MCPFE 2015). In order to improve knowledge and data collection systems to get more information on the SFM, indicators were updated during the various MCPFE. In fact, their last update was made in 2015 in Madrid Ministerial Conference.

Those C & I of SFM have been locally adapted in many countries, taking into consideration the specific conditions of the national forest resources: consequently, the common definition of C & I for SFM permitted the affirmation of some voluntary forest certification schemes. Forest management certification provides independent, third-party verification of adherence to a defined set of management standards that promote and measure SFM, (MacDicken *et al.* 2015).

Besides being a tool for environmental protection, forest certification can also be a useful marketing tool. In fact, for a firm the convenience of endorsing forest certification for its products lies in the preference given by the consumer to the certified product, a possible willingness to pay a premium price, (Carbone 2010). For managers of public institutions, ethical values also have a place, following that SFM certification communicates to the public that forests are managed in a sustainable way, adopting internationally recognized standards of good practice, (PEFC Italia 2017 c).

The most widespread forest certification schemes include: FSC (Forest Stewardship Council) a very comprehensive and flexible scheme with very high requirements, CSA (Canadian Standards Association) and SFI (Sustainable Forestry Initiative) mostly related to the North American environment (Fischer *et al.* 2005), PEFC (Program for the Endorsement of Forest Certification), (Paletto *et al.* 2017). In particular, the PEFC certification scheme was established in 1998 on the initiative of private companies and forest owners in northern Europe, in order to create an eco-certification and ecolabelling system suited to the needs of the market and timber producers: it had a strong link with the SFM C & I approved in the Pan-European Conference in Lisbon (Santopuoli *et al.* 2015).

The PEFC standard differentiates itself in particular because each country develops their own standards that are adapted to international criteria, while other schemes, like FSC, have an international one standard, nationally adapted in each country, with less care of peculiarities of the local social background and environmental frame (Frenell Staaf and Matsson 2017). Moreover, FSC directly releases the certification by itself, while PEFC uses accredited certification third bodies to issue the certification, (Alriksson 2016). Bearing in mind these considerations, and in particular the possibility of the PEFC certification scheme to respond more satisfactorily to the peculiarities of the national and regional forestry sector (especially a reduction in certification costs for highly

fragmented Italian forest properties), (Bernetti and Romano 2007), in this work the PEFC standard was taken into account, considering also the wider diffusion of this certification scheme in Europe with respect to other schemes (Maesano *et al.* 2018).

Looking at the European Union territory, let us examine both end cases, with regards to both the adopted certification and the woods managed under forest management unit plans.

Finland is the first country with forest areas (95%) subject to PEFC certification of SFM, (PEFC 2017). In fact, the forest sector is on the basis of the economy of the country, contributing 5% today to the national GDP. According to data reported by the National Forest Inventory, Finnish forests are mostly privately owned, with an area under planning 67% of the whole, while all the public forests have management plans, (State of Finland's Forests 2012). The PEFC scheme was preferred because it is cheaper from an economic point of view, more suitable for small forest owners, and offers the possibility of group certification for small forest areas, (Lopatin *et al.* 2016). Quite the opposite to the Finnish territory, in Greece there are no PEFC-certified forest areas of SFM and only three companies have adopted the Chain of Custody (CoC) certification, (PEFC 2017). Georgiadis and Cooper in "2007" showed that forest areas in Greece could be subject to forest certification, but regarding management practices, a shortcoming of health and safety and lack of professional training of workers, lack of communication between the stakeholders constituted severe weaknesses points, (Kazana *et al.* 2015). In fact, non-managed forests are usually degraded and endangered by wildfires, grazing and soil erosion (Georgiadis and Cooper 2007). Most of Greece's forests, equal to 70.9% of the whole country forest area, year 2010, (FAO 2010), are publicly owned, and even if the territory has high plant and animal biodiversity, the forestry sector is highly neglected.

As for the Italian territory, according to the data reported by the PEFC-Italy database 2017 (PEFC Italy 2017 b), 10 out of 21 of the regions have adopted SFM certification, summarizing 550.8 thousand ha of certified forest area. With regards to the explained framework, also in Italy, some northern regions have a significant part of forest territory under certification, while in the south, forest certification (both of CoC and SFM) is quite rare or absent.

With regards to Sicily, the region considered in this work, currently there are no certified forest areas, and there are only two companies with a Chain of Custody certification.

Following the finding of the absence of SFM certification in the region, in order to verify the common understanding of a significant sample stakeholders with regards to forest certification, a cognitive survey involving a sample of local foresters have been carried out to analyze the acquaintance of forest certification, the perceptions of possible certification benefits and costs and

the willingness to pay for forest certification (specifically for eco-certified products and for certification costs) .

Starting from these premises, the purpose of this work is to verify the possibility of applying the Criteria & Indicators of the PEFC certificate, by comparing two public owned forests in the Sicilian territory: the woods of the Bivona municipality (AG), located on the Sicani Mountains and a forest area on the Madonie Mountains (PA).

The two areas are managed under forest management unit plans recently updated. The forest management plan (FMP) is the central instrument for planning and harvesting at the level of each forest stand, (Buliga and Nichiforel 2018). Forest certification process requires a FMP that has to include strategies for monitoring management practices to ensure that sustainability requirements are met, (Harshaw *et al.* 2009, Maesano *et al.* 2018). In fact, without a scientifically feasible FMP, it would not possible to have a sustainable supply of wood, nor would forest certification and international marketing of wood products be possible, (He *et al.* 2015). For this reason, the following paragraph highlights the current state of Italian forest planning at two levels: national and regional. In addition, an examination is carried out on the Sicilian forest sector in order to provide a broader and more general vision related to the case studies analyzed.

SHORT BACKGROUND ON FOREST PLANNING AND FOREST SECTOR IN ITALY AND SICILY

In Italy, since 1977, the administrative functions in the fields of agriculture and forests, hunting and fishing, soil protection and hydrogeological constraints and nature protection have been transferred to the regional authorities within some state framework laws. Even if forest management plans, mainly focused on the production aspect, were compulsory from 1923 under state forest law for public owned forests, in Italy only a 14% share of forests is subject to forest management unit plans (settlement plans, business plans), and a lack of planning affects mainly the forests of southern regions. The majority of forests are only subject to general regulations of a prescriptive nature (PMPF)[1] at provincial level, (V.V. A.A. 2016).

In Sicily, regional laws refer to forest management plans, since 1989, and in 2006 the new regional forest act introduced the concept of sustainability in the forest management plans. Anyway, to date the regulations on planning have been disregarded: in fact, there are very few Sicilian forest areas are managed under plans: this lack of forest planning limits also the possibility of implementing the forest certification of SFM. In addition, with regards to the management plans of

[1] PMPF: Italian acronym for “Prescrizioni di Massima e Polizia Forestale”– litterally “General and Forest Police Rules”

the many protected areas included in the Nature 2000 Network, only conservation strategies are given and not any detailed forest survey and intervention requested.

Many of the critical issues of the Sicilian forest sector and forest ecosystems are similar to those found in another area of the Mediterranean Basin, Greece. For example, for what concerns the phenomenon of forest fires, their annual number, both in Sicily and in Greece, was increasing in the period 1985-2011, (Turco *et al.* 2016). Moreover, the number of wildfires occurred in Sicily in 2017, which is 1113, was similar, as order of magnitude, to that of Greece, (1083). This phenomenon is favored and facilitated by unsustainable forest management practices, degradation of ecosystems and their services, as well as the continuity of fuels of very flammable forest tree species, (JRC 2017).

In fact, unlike other areas of central and northern Europe with a high productive vocation, Sicilian forest ecosystems are characterized by a strong ecological fragility, as far as, from the socio-economic point of view, by a limited development of the sector, fragmentation, and dispersion of productive forests; so that the Sicilian woods have mainly an ecological and landscape value instead of a productive one. The local market is predominated by sawn timber and semi-finished products of foreign imports, (ARTA Sicilia 2010; Federlegno Arredo 2016), while potential local economic resources, especially if related to marginal areas and depopulation can be glimpsed in non-wood forest products, and short food chain. On the other hand, the production and the trade of forest biomass for energy use are very limited too.

Overall, the island's forest heritage is affected by disturbing factors such as climate changes in the Mediterranean area, the spread of plant diseases and the fires: issues that a proper management of forest resources could limit, developing also opportunities for economic-social growth in rural areas.

Moreover, the complexity of the normative and a bureaucratic binding system, both at the national and regional scale, makes the multifunctionality of the forest a burden for businesses, rather than an added value, consequently penalizing entrepreneurs in terms of costs and competitiveness, (MIPAAF 2013). Such a combination of these factors results in a poor active management of the territory and of the forest heritage. Furthermore, the progressive depopulation of the mountain and rural areas and the consequent increase in unmanaged territories worsen the risk of hydrogeological instability and ecological inefficiency (senescence of stands, forest fire risk, plant diseases caused by biotic agents, etc.), (Pizzuto Antinoro *et al.* 2014).

Forms of incentives as far as political and social recognition to the role of operators in the sector and the developing partnership and integrated territorial management, seem to be solutions to solve the widespread crisis in the Sicilian forestry sector. In addition, another way to foster the

forestry sector can be found in forest-wood-energy supply short chain, by carefully sizing the withdrawal with the local resources.

MATHERIALS AND METHODS

Study areas

The study areas were chosen following their significant and representative characters of environment and biodiversity, as far as the different management objectives (respectively wood production for energy purposes, expansion of activities of ecotourism).

Both sites are publicly owned, in fact they are property of the regional administration.

The first is located in the municipality of Bivona[2] on the Sicani Mountains, the second one is a forest area on the Madonie Mountains [3] (Figure 1).

(FIGURE 1 *Geographical position of case studies in Sicily)*

The forests of Bivona, cover an area of about 962 ha. It falls partly within the Natural Park of Sicani Mountains and the SAC (Special Area of Conservation) ITA 020029. As for the geological aspect, the substratum of the area is mainly marls, dolomites, dolomite limestone, and silicates, while the prevalent soil types are mainly mostly composed by Vertisols and Brown soils. The average annual rain is about 794 mm, and the average annual temperature is about 17 ° C. The bioclimate according to the classification of RIVAS-MARTINEZ (1996), (as well as reported in "La Mela Veca *et al.* 2014"), can be defined as of the lower Subhumid Mesomediterranean type. Currently, the forest consists mainly of reforested stands mostly composed by conifers such as: *Pinus halepensis* Miller, *Cedrus atlantica* Manetti, *Pinus nigra* Arnold, *Cupressus sempervirens* L. and broadleaves like *Eucalyptus* spp.. Among the autochthonous tree species, there are *Quercus ilex* L., *Quercus pubescens* Willd, *Fraxinus ornus* L., etc., (La Mela Veca *et al*. 2014).

The forest area in the Madonie Mountains covers more than 526.7 ha, it is entirely included in the Madonie Regional Natural Park (covering the 1,32% of entire Natural Park's area) and in the SAC ITA 020016, (covering the 6,30% of entire SAC's area). Marly limestone and dolomite associated with Mesozoic siliceous rocks and arenaceous rocks form the geologic underlayer, originating mainly brown and lithic soils. The average annual rain is 824.5 mm, the annual temperature varies from 8° to 16° C following the altitude on the sea level. The bioclimate according to the classification of RIVAS-MARTINEZ (1996), and Bazan *et al.,* 2015, varies

[2] "37°38'28.19''N 13°25'23.29''E"
[3] "37°53'11.53''N 13°59'02.94''E"

between Mesomediterranean and Supramediterranean for the thermotypes and between Umid and Subhumid for ombrotypes.

The vegetation of the area is mainly composed of mesophilous and mesoxerofile beech woods, belonging to the *Luzulo-siculae-Fagetum* association, holm oaks of the *Aceri campestris-Quercetum ilicis* association: the latter type is concentrated in the northern belt. There are also some reforestations sparse stands of conifers, with *Cedrus atlantica* Manetti and *Pinus nigra* Arnold, (Bertani *et al*. 2015), that covers for a total of 9.05 ha, in the amount of the 1.7% of entire forest area.

Methods

The work was mainly carried out in three phases: the first concerning the application of C&I of SFM, the second aimed at knowing the attitude of the managing boards to begin a forest certification process, the last regarding a survey on the knowledge, the perception of forest certification and the willingness to pay for both eco-certified products and certification costs.
In fact, in order to verify the compatibility of the forest resource management of the study areas with the PEFC forest certification standard, a systematic analysis of the Criteria & Indicators contained in the ITA 1001-1 standard (2017) was carried out. ITA 1001-1 standard (2017) is the latest issue of C&I standards revised for the Italian forest certification process by the local PEFC Committee. This standard consists of 6 criteria, 36 normative indicators, on which the verification of the certification criteria is based; 10 descriptive indicators are also reported. Therefore, territorial planning tools and the documentation of the two forest areas were examined. Information and data were collected from the analysis of the two management plans, (Bertani *et al.*, 2015, La Mela *et al.*, 2014), of the local forest regulations (Regione Siciliana, 2006), the regional Forest Fire Prevention Plan, (Regione Siciliana, 2017), the Natura 2000 network management plans, (V.V. A.A., 2008, 2010), the thematic cartography, as far as a fieldwork of surveys and interviews with stakeholders (these last, e.g., for the Criteria 6). The table 1 (in Annex I) shows, in detail, the C&I of ITA 1001-1 standard and for each of these, it reports the informative source required.
This work made it possible to gather information and data required by the ITA 1001-1 standard, and the drafting of SFM Handbook. An exhaustive example of the analysis carried out is given with regards to the criteria n.3 and 4, (Table 2).

(TABLE 2 *Exemplary analysis of the application of the criteria 3 and 4 in the two case studies)*

The total, partial or non-compliance with the thresholds established by the normative indicators was verified and some possible critical points detected. No judgment of conformity was expressed with regards to the informative indicators.

The assessment of the organizational level and the attitude of the managing boards to begin the certification process of the SGM was carried out by filling out an evaluation matrix provided by PEFC-Italia (see later Table 4), that was submitted, face-to-face, to two general senior managers as representatives of the regional administration that owns and manages the two study areas. The evaluation matrix consists of 20 requirements, 10 related to the awareness of the level of management and forest planning and the other 10 related to the level of internal organization of the company. Furthermore, 7 requirements are fundamental (i.e. indispensable for undertaking a certification process), while 13 are complementary. The matrix is structured in order to provide binary responses (yes / no). If the answer is positive, the score is equal to 1, vice versa the score is equal to 0. When the organization's score approaches the maximum score foreseen by the matrix (20) there will be fewer obstacles in the start of the certification process (Ilarioni *et al.* 2013, PEFC Italia 2017 a).

In particular, the first and second phases were jointly developed, as they allow to evaluate, all-round, the intrinsic features and the management system of the study areas with respect to the parameters required by the certification process of the SGM.

As regards the survey on knowledge and perception of forest certification in the local regional area, a short questionnaire (see the Annex II), was proposed to the 60 people attending to a technical workshop of local foresters held in Palermo on 16th April 2018, to present the Forbioenergy Interreg project results as transferring activity. Professionals, public forest managers and forestry graduates as far as some forestry students attended the meeting.

Even if the sample was objectively restricted[4] and not strictly related with the case study areas, the results of this investigation, as hereafter discussed, were encouraging. The questionnaire was structured in nine points, of which three related to the characteristics of the respondents (age, sector of work, level of education). In the other points, the respondents were asked to respond to multiple choice questions or to specific questions measured as a dichotomous (“yes” or “no”), regarding the certification processes: knowledge and acquaintance of Certification schemes, usefulness and motivation, willingness to pay for eco-certified products and for certification costs.

[4] Even if limited to 58 people, the sample can be considered significant in a regional context of little relevance for the forestry sector, where currently foresters are seldom employed both in public and private services

RESULTS AND DISCUSSION

The questionnaire investigation

The questionnaire was generic and not referred to the case studies and was aimed only to test the knowledge of the certification theme among local technicians and managers in the sector.
Of the 58 technicians and managers who responded to our questionnaire, 65.5% were male, 82.3% were graduated (mainly agronomy and forestry M.Sc.), 7% hold a high school diploma, the remaining didn't declare their level; with regards to their employment: 41.3% were professionals, 17.2% public managers, forestry students and not employed fresh graduated 13%, while the remaining didn't declare their position. The age ranged from 18 to 34 (34.4%), 35 to 49 (41.4%), over 50 (24.2%), (see Table 3).

(TABLE 3 *Respondents' characteristics)*

The analysis of the answers resulted from the questionnaire showed that the majority of them (82.8%) were acquainted with the certification processes, all considering it as a positive and useful opportunity, and 55.2% knew the chance of both SFM and CoC certification. Conversely to other cases study (e.g. Tian *et al.* 2018) the most part of the respondents (89.7%) referred the willingness to pay for the costs to participate in forest certification program.

Anyway, it must be said that the majority of them weren't forest owners. For what concerns the willingness to pay for certified wood products, 55.1% were willing to pay a price premium, 27.6 % were not willing to pay, and the remaining did not provide any answers. These results confirm the usefulness that respondents attribute to forest certification.

Referring to the driving motivation, 68.9% attributed both ecological and economical values as good reasons to adopt SFM certification, while 20.7% recognized mainly sustainability values and only 10.3% put forward the economic benefits of certification.

Applying the Criteria & Indicators of the PEFC and analysis of evaluation matrix

The results of the analysis of C & I for each of the two areas are reported in Table 5: note that for some normative indicators no judgment is given following the absence of grounds for evaluating them in the studied areas.

The results emerging from the checklist are also expressed as a percentage, highlighting for the Bivona forest a 58% compliance, 8% partial compliance, 19% non-compliance and the

remaining 14% not taken into account. With regards to the study area of the Madonie Mountains a 64% positive compliance, 17% negative compliance, 11% partial compliance were found, while the remaining 8% wasn't taken into consideration (Figures 2-3). The evaluation matrix compiled by the managers of the two areas (Table 4) shows some more information: the score on the requirements for applying the PEFC certification, in both cases, was 60% against the required full compliance (100%), i.e. 12 points out of 20 for positive response.

These last considerations confirm, as first, the planning deficiencies of the examined context, if we consider that in other contexts, where planning is more efficient, the adopted plans respond much more effectively to the SFM criteria and indicators (e.g. Mrosek *et al.* 2006).

(TABLE 4 *Evaluation matrix)*

(TABLE 5 *Checklist of the verification process of the Sustainable Forest Management system to the 6 PEFC criteria)*

(FIGURE 2 *Checklist results expressed as percentage for the municipal forest of Bivona)*

(FIGURE 3 *Checklist results expressed as percentage for the forest area in Madonie Mts)*

The analysis of the checklist highlights some critical issues, represented by non-compliance or partial compliance judgment expressed for some criteria and indicators. With regard to the forest of Bivona it was found that:

- there is a considerable variation of the forest area due to the long-standing problem of wildfires (criterion 1, indicator 1.1 a); Forest fire prevention plans at regional and local level are devoted to cope this and to reduce the impact of wildfires;
- there is no a system to record and catalog the damages occurred in forest (criterion 2, indicator 2.1a);
- there is no active and continuous monitoring system in the woods, for this reason the indicator 2.2a, criterion 2 is partially compliant;
- a greater presence of alien species compared to the indigenous ones was observed (criterion 4, indicator 4.2 a). In this regard, silvicultural interventions are planned and indicated in the relative management plan, aimed at renaturalising the area;
- there is a difficulty to maintain appropriate biological diversity in reforestation (criterion 4, indicator 4.2 c);
- there is a prevalence of alien forest species in the area (partial compliance for the indicator 4.3 a, criterion 4);

- as it is a monoplane forest, the predicted threshold is not reached in the proportion of mixed non-monolayered forests (criterion 4, indicator 4.3 b); These two last depend, of course, by the widespread of the reforested stands made, in the 50s to70s of the last century, with conifers and few other species: the current management plan is especially orientated to the target of renaturalization of those stands;
- severe damages to the forest trees regeneration were observed, due to the presence of grazing domestic animals (criterion 4, indicator 4.5 b). This is a long-standing problem in Sicily, even if currently less diffused because of the abandonment of the rural areas. Anyway, it can be solved by intensifying the local forest police controls, in order to verify the compliance to the local rules;
- in the management plan the activities and the operating techniques related to the execution of the wood hauling are not carefully planned (partial compliance for the indicator 5.2 c, criterion 5);
- in Sicily, a forest improvement fund has never been established (criterion 6, indicator 6.9a).

With regard to the forest area of the Madonie Mountains, the most significant problems that have emerged concern:
- the lack of a system for recording and cataloging the damages occurred in forest (criterion 2, indicator 2.1a), as well as in previous case;
- the absence of active and continuous monitoring system in the woods, (partial compliance for the indicator 2.2a, criterion 2);
- the lack of data in the management plan for the budget between increase and use of wood mass over the years (criterion 3, indicator 3.3 a). With regard to this, the plan must be further updated, following also a set of new guidelines for forest plans drawing recently issued by the regional authority;
- the presence of a forest road system that is not equally distributed in the area (partial compliance for the indicator 3.5a, criterion 3);
- the presence of a greater proportion of monoplane woods than the threshold established in the proportion of mixed non-monolayered forests (criterion 4, indicator 4.3 b). These difficulties are almost the same observed in the previous plan;
- the lack of monitoring and checking system of damage due to the presence of wildlife populations (criterion 4, indicator 4.5 a);
- the absence of techniques of wood hauling in the forest management plan (partial compliance for the indicator 4.8a, criterion 4);
- the lack of specific indications in the management plan relating to logging practices and techniques (criterion 5, indicator 5.2 c). This is a shortcoming of the plan and reveals a weakness of

406 the sector in Sicily: the lack of specific professionalism in regional and local offices, as far as the
407 insufficient presence of foresters among professional consultant;
408 - the lack of management initiatives aimed to increase the social value of the forest (partial
409 compliance for the indicator 6.6a, criterion 6);
410 - the absence of a forest improvement fund (criterion 6, indicator 6.9a).
411 In short, the analysis of those two different forest contexts highlights that the results of
412 compliance/ non-compliance attributed to the various indicators aren't only related to the intrinsic
413 aspects of the two areas, but also on their management plans and the governance of forests
414 (common to both, as previously depicted).
415 The SFM criteria, in addition to considering the multifunctional aspects of the forest
416 (economic, ecological, social), also assess the legal and regulatory aspects of forest policy and its
417 capacity to provide guidelines for framing the conservation strategy and sustainable management,
418 for example, see criterion 4 (indicators 4.4 a, 4.8 c) of PEFC. And this is really relevant being both
419 case studies included in protected areas.
420 Some indicators taken into account in this study are strongly significant to evaluate the level
421 of SFM, especially in Sicilian forest realities. In particular, the 1.1a indicator, concerning the
422 change in the forest area, highlights two important aspects: the increase in the forest area (and/or its
423 decrease), aspects found in the two areas examined the increase in the forest, as in the case of the
424 Madonie case. The increase of forest surface, even if on one hand represents the free natural
425 evolution of the wood, on the other it must be considered to the detriment of which areas this
426 evolution takes place (e.g. areas with natural pastures and grasslands, areas with sclerophyll
427 vegetation, etc.), and if it can always be considered an advantage especially from an ecosystem
428 diversity point of view. While the certification C & I consider the increase of forest area always as a
429 positive factor.
430 On the other hand, as regards the reduction of the forest area as in the case of the Bivona
431 forest, the analysis of this problem leads to the factors responsible, both anthropic and natural (e.g.
432 fires, landslides, pathologies, etc.). The necessary corrective measures to reduce such events are
433 partly taken into consideration and fostered in the last regional Rural Development Program (RDP)
434 funding.
435 The indicator 3.1a, which evaluates the percentage of forest area managed according to
436 forest management unit plans is also highly indicative. The lack of management plans in the Sicilian
437 forests entails a lower capacity for control and intervention, while this last should be compulsory for
438 the development of the Sicilian forestry. A new set of guidelines for forest management unit plans

drawing have been issued by the regional authority in order to cope this problem, as far as the funding for planning is currently provided through the regional RDP.

In fact, planning is a continuous process that implies the control of the results achieved, so that the choices of the plan can be gradually revised and improved on the basis of the new knowledge acquired in the meantime. Therefore, the indispensable monitoring system must be closely connected to the management plan through SFM indicators, (Corona 2012).

The indicator 4.2 a, which deals with the differentiation between indigenous and introduced species, is also particular significant. It is very useful evaluation parameter of the SFM for the Sicilian forest context, because the forest coverage in Sicily is constituted for about 36% by reforestation (ARTA Sicilia 2010, La Mela Veca *et al*. 2016) mainly composed by alien species, as in the case of the Bivona woods. Consequently, in these areas the silvicultural interventions should be oriented towards a process of renaturalization. This must be appropriately planned and regulated by the planning tools.

In particular, the non-conformities or partial conformity found in some indicators for both forests depends on the management, such as: the lack to register on the health status of the woods; the lack of a surveillance system for detecting and stopping illegal activities; the absence of monitoring of the wild grazing damages (especially for the Madonie complex); the lack of internal forest road system; the insufficient and inaccurate information regarding the average annual quantity of wood mass produced in each forest (only data at the provincial level linked to the sale of timber and not specific data for the study sites were available). Moreover, no professional training and refreshing courses for internal crews were carried out, especially any linked to the SFM.

On the other hand, the aspects related to silvicultural and ecological interventions were found to comply with the regulations. In particular, a significant contribution to the compliance of some criteria and indicators is related to the fact that both studied forests fall into Special Areas of Conservation. Effectively, some indicators are related with the 3 and 4 criteria, aimed to evaluate management aspects related to particular environmental situations such as the presence of endangered species, monumental trees, maintenance of habitats for biodiversity, etc. This made it possible to carry out a monitoring aimed not only at the PEFC certification, but also at the verification of the implementation of the guidelines contained in the management plans of the Natura 2000 areas.

In short, the audit carried out achieved the purpose of highlighting the difficulties encountered and the strengths of the planning and management examined.

Anyway, some aspects of the analyzed process can be examined under a different point of view. Even if the criteria and indicators of PEFC, for the purposes of monitoring the SFM, are

undoubtedly effective and selective, following this experience some of them revealed itself complex and maybe even redundant. A detailed analysis of some aspects can help improve the efficiency of the certification system. Moreover, other sources have reported limits of the schemes and indicators adopted, in order to help adapt the scheme to local needs (NEPCON 2012). This is also demonstrated by the constant updating of certification standards.

In fact, some indicators deal with different aspects of one same argument and therefore it would be appropriate for all aspects concerning the same subject to be merged into a single indicator. For example, some parameters of indicator 3.1: parameter 2, which relates to the methods of logging operations, grazing and civic use, as well as management activities related to the production of non-wood forest products and recreational services. As far as the aspect concerning grazing is concerned, it is included in indicator 4.5 b; civic uses are again required by indicator 6.3 a; parameter 4 relating to protected area directives is treated in indicator 4.8 b; the parameter 6 concerning the preservation and where necessary the increase of an adequate amount of wood decomposing in the forest, is also included in the indicator 4.6 a. Moreover, the aspect related to the monumental trees treated in the indicator 4.6 a is partly dealt with in the indicator 4.7 a. Again, in Italy the subject considered by the indicator 4.2 b, concerning the quality of the propagation materials, is superfluous since the use of such materials requires an appropriate certification as provided for by Directive 1999/105 / EC, transposed by Legislative Decree no. n. 386/03.

Finally, some considerations on the requirements of indicator 4.3b (Variation in proportion of highly structured, mixed-species forest) should not be overlooked. In this regard the criticality threshold establishes that the area consisting of mixed non-monoplane woods must be more than 50% of the total. This threshold is significant in the case of reforested stands, on the contrary it can be rather restrictive for natural forests since their structural development has been determined by their adaptive capacity and varies with the location. In fact, the forest can be defined as a mosaic of structural situations, and not all species build mixed consortia with multiplane structures. This is the case of beech, which has characteristics of regeneration and growth of young plants that tend to single-layered structure, already at a young age. Although multiple layers structure, in some contexts, can be defined in nature as one of the most common objectives in naturalistic silviculture, it can be also defined as a transitory phase. In fact, the pure monoplane wood can also be natural, while not necessarily the mixed multilayered forests are always expression of a natural evolution (Paci 2004).

CONCLUSIONS

The present work allowed to evaluate and monitor the SFM of two significant areas in the Sicilian forest context through the PEFC criteria and indicators. At present, following our analysis, it would not be possible to positively conclude the process of certification of the management of the two areas. This is due to some documentary deficiencies in the management plans, due to differences in procedures and in some cases lack of fundamental assumptions (such as lack of professional updating of crews). On the other hand, a survey on the interest of certification, even if limited to a small number of technicians, has shown the interest of these towards the acquisition of certification process as well as the Chain of Custody. The answers to a questionnaire on the subject are very encouraging and demonstrate their knowledge of the topic and its relevance.

Anyway, the aim of this work was to verify the possibility of applying the criteria and indicators of the PEFC certification to two significant and representative case studies: this gave the opportunity to highlight the critical aspects of the planning system adopted but also the positive factors already contemplated in it, as well as expressing assessments of the applicability of the certification process with an overall view of the process itself and its characteristics.

Highlighting the shortcomings of the planning system adopted by the region, as revealed in the application of the certification process of the two case studies, can actively contribute to the definition of higher local standards and more responsive to the need to adopt an effective SFM. And this is a strength of the method required by certification, that in some cases it has also proved to be an engine for the improvement of the system of planning and cultivation practices locally adopted (Newsom *et al*. 2006).

Moreover, there are possible intrinsic shortcomings in the certification system adopted with regard to the specificity of some specific aspects of the territory examined, as previously discussed. The need for an adjustment of the criteria and indicators can be added to the periodic revisions by the certification committee.

Consequently, this study allowed us to examine in detail the C&I of PEFC in order to evaluate their adaptation to the Sicilian forest sector, permitting also, beyond of the certification process, to analyze the SFM in the two pilot areas. As first, we have to start from considering the historic role of forestry in Sicily, and some reflections that refer to the evolution of the forest Ecosystem Services required by the local society. Traditionally, the forests were mainly managed following a wood production approach, later, towards the middle of the last century, the management was mainly oriented towards the tourist-recreational utility and the conservation of biodiversity. Today, despite of rules that forbid to protect, our forest heritage isn’t managed through an effective planning system able to enhance its natural values.

However, some solutions are possible and already undertaken. Recently, the regional authority has issued a rule that regulates the drafting of management plans and their contents. This will allow the consistency of the data collected and the management methods. In addition, most importantly, it has issued calls through the Rural Development Program that explicitly funded the drafting of management plans for public and private properties. However, the difficulty of the fragmentation of property remains, an issue that could be resolved by favoring associationism. But this latter is a difficult objective in the absence of traditions, as demonstrated by the lack of response to the call for financial support recently issued under the Rural Development Program. In this regard, it would be useful to encourage greater participation and fostering by the ecological associations and the professional categories of consultants and farmers.

Finally, in the new edition of the Regional Forest Plan (RFP), the strengths and weaknesses of the forestry chain were recognized. And, following specific analyzes carried out also with local universities, the addresses and priorities of spending for the sector have been identified.

This could, at least partially, solve the problem highlighted by the non-compliance with criterion 6.9a.

Furthermore, in the RFP, specific reference is made to the need for the re-naturalization of the reforested stands (see also the non-conformity of on criterion 4.3b), which is also a topic funded by the Rural Development Program.

Therefore, fostering forest certification in this context would be a valid instrument suitable for the application of SFM system. Even if it entails costs to adopt it, at the same time, however, it stimulates an improvement of the organizational and administrative structures, a greater transparency in management that improves the image and the prestige of the companies and public management too. Moreover, with the relaunch of the tourist-recreational and naturalistic function, it can be a development engine for those economically marginal territories.

ACKNOWELDGEMENT

The valuable suggestions made by anonymous referees is gratefully acknowledged

573

574 REFERENCES

575

576 ALRIKSSON, S. 2016. PEFC. Föreläsning i kursen 1MX033, Certifierat skogsbruk. Dissertation.
577 Kalmar, Växjö: Linnéuniversitetet.

578 ARTA SICILIA 2010. Rapporto sullo stato delle foreste in Sicilia 2010, RAF Sicilia. Sherwood-
579 Foreste ed Alberi Oggi anno 17, **10.**

580 BAYCHEVA-MERGER, T. and WOLFSLEHNER B. 2015. Evaluating the implementation of the
581 Pan-European criteria and indicators for sustainable forest management- A swot analysis.
582 *Ecological indicators* **60** (2016): 1192-1199.

583 BAZAN, G., MARINO, P. and GUARINO, R. 2015. Bioclimatology and vegetation series in
584 Sicily: a geostatistical approach. *Annales Botanic Fennici* **52**: 1-18.

585 BERNETTI, I., ROMANO, S., (ed.) 2007. *Economia delle risorse forestali*: **II**, 692.

586 BERTANI, R., PUTZOLU, M. AND SANTORO, E. 2015. *Piano di Indirizzo agro-forestale*
587 *dell'area sperimentale delle Madonie (PA).*

588 BULIGA, B. and NICHIFOREL, L. 2018. Voluntary forest certification vs. stringent legal
589 frameworks: Romania as a case study. *Journal of Cleaner Production* **207** (2019) 329-342.

590 CARBONE, R. 2010. La sostenibilità delle biomasse: l'impatto ecologico delle nuove tipologie di
591 utilizzazione sulle comunità microbiche del suolo in relazione alla diffusione dei marciumi
592 radicali. *Tesi di Laurea. Università degli studi di Milano.*

593 CORONA, P., 2012. Gestione Sostenibile delle risorse forestali nelle aree protette. *Silvae,* **12.**

594 FAGGIN, JM., BEHAGEL, JH. and ARTS, B. 2017. Sustainable Forest Management and Social-
595 Ecological Systems: An Istitutional Analysis of Caatinga, Brazil. *Forests* 2017, **8**, 454, doi:
596 10.3390/f8110454.

597 FOREST EUROPE 2015. Updated pan-European Indicators for Sustainable Forest Management as
598 proposed by the FOREST EUROPE Advisory Group on the updating of the pan-European
599 Indicators for Sustainable Forest Management. Available at:
600 https://www.foresteurope.org/sites/default/files/ELM_7MC_2_2015_2_Updated_Indicators.pdf

601 FAO 2010. Global Forest Resources Assessment Country report Greece 2010. Available at:
602 www.fao.org/docrep/013/al515E/al515E.pdf

603 FEDERLEGNO ARREDO 2016. Lo stato di salute della filiera del legnoarredo. Rapporto FLA
604 2016. Available at: www.federlegnoarredo.it/.../Filiera%20e%20Sicilia%20-
605 %20press%20kit.pdf

606 FISCHER, C., AGUILAR, F., JAWAHAR, P. and SEDJO, R. 2005. Forest certification: Toward
607 common standards? Discussion Paper 05-10. April 2005. *Resources for the Future*,
608 Washington, D.C.

609 FRENELL STAAF, C. and MATSSON, E. 2017. Privata skogsägares syn på ansvarsamt behovet
610 av kunskap ochinformation om PEFC- certifieringen. Dissertation. *Networked Digital Library*
611 *of Theses & Dissertations.*

612 GEORGIADIS, N. and COOPER, R.J. 2007. Development of a forest certification standard
613 compatible with PEFC and FSC's management requirements. A case study from Greece.
614 *Forestry*, **80**, 2.

615 HALALISAN, AF., ABRUDAN, IV. and POPA, B. 2018. Forest Management Certification in
616 Romania: Motivation and Perceptions, *Forests* 2018, **9**, 425; doi: 10.3390/f9070425.

617 HARSHAW, HW., SHEPPARD, SRJ. and JEAKINS, P. 2009. Public attitudes toward sustainable
618 forest management: opinions from forest-dependent communities in British Columbia. BC
619 *Journal of Ecosystems and Management* **10** (2): 81-103.

620 HE, M., WU, Z., LI, W. and ZENG, Y. 2015. Forest certification in collectively owned forest areas
621 and sustainable forest management: a case of cooperative-based forest certification in China.
622 *Small-scale Forestry* (2015) **14**: 245-254.

623 ILARIONI, L., NASINI, L., REGNI, L., BRUNORI, A. and PROIETTI, P. 2013. Certificazione
624 forestale come strumento della gestione sostenibile di foreste e piantagioni. *#Natura, Rivista di*
625 *ambiente e territorio dell'Arma dei Carabinieri.*

626 INTERGOVERNMENTAL PANEL ON FOREST OF THE UNITED NATION 1995. Available at:
627 http://www.un.org/documents/ecosoc/cn17/ipf/1995/ecn17ipf1995-3.htm

628 JOINT RESEARCH CENTRE TECHNICAL REPORTS 2018. Forest Fires in Europe, Middle East
629 and North Africa 2017. doi:10.2760/663443

630 KAZANA, V., KAZAKLIS, A., STAMATIOU, C., KOUTSONA, P., BOUTSIMEA, A. and
631 FOTAKIS, D. 2015. Swot analysis for sustainable forest policy and management: a Greek case
632 study. *International Journal of Information and Decision Sciences.* **7.**
633 10.1504/IJIDS.2015.068116

634 LA MELA VECA, D., PIZZUTO ANTINORO, M. and TRAINA, G. 2014. *Proposta di piano di*
635 *gestione della biomassa forestale dei boschi demaniali del comune di Bivona (AG).*
636 Dipartimento Regionale dello Sviluppo Rurale e Territoriale, Regione Siciliana

637 LA MELA VECA, DS., CULLOTTA, S., SFERLAZZA, S., and MAETZKE, F.G. 2016.
638 Anthropogenic Influences in Land Use/Land Cover Changes in Mediterranean Forest
639 Landscapes in Sicily. *Land* **5**, 3; doi:10.3390/land5010003

640 LOPATIN, E., TRISHKIN, M. and GRAVILOVA, O. 2016. Assessment of compliance with PEFC
641 forest certification indicators with remote sensing. *Forests* 2016, **7,** 85.

642 MACDICKEN, KG., SOLA, P. and HALL, JE. 2015. Global progress toward sustainable forest
643 management. *Forest Ecology and Management* **352**: 47-56.

644 MAESANO, M., OTTAVIANO, M., LIDESTAV, G., LASSERRE, B., MATTEUCCI, G.,
645 SCARASCIA MUGNOZZA, G. and MARCHETTI, M. 2018. Forest certification map of
646 Europe. *iForest* **11**: 526-533 - doi:10.3832/ifor2668-011

647 MENDOZA, GA. and PRABHU, R. 2005. Combining participatory modeling and multi-criteria
648 analysis for community-based forest management. *Forest Ecology and Management* **207**(1–2):
649 145–156.

650 MINISTERO DELLE POLITICHE AGRICOLE ALIMENTARI E FORESTALI (MIPAAF) 2013.
651 Fabbisogno di ricerca e innovazione nel settore forestale italiano.

652 MLADENOFF, DJ. and PASTOR, J. 1993. Sustainable forest ecosystems in the Northern
653 hardwood and conifer forest region: concepts and management. In: Aplet GH, Johnson N,
654 Olson JT, Sample VA (eds.) *Defining sustainable forestry*. Island Press, Washington, DC, pp.
655 145-180.

656 MCPFE 1993. Second Ministerial Conference on the Protection of Forests in Europe 16-17 June
657 Helsinki/Finland. Available at: www.foresteurope.org/docs/MC/MC_helsinki_resolutionH1.pdf

MCPFE 1998. Third Ministerial Conference on the Protection of Forests in Europe n 2-4 June 1998, Lisbon/Portugal. Available at: https://www.foresteurope.org/docs/MC/MC_lisbon_resolutionL2.pdf

MCPFE 2015. State of Europe's Forests 2015. Available at: https://foresteurope.org/docs/fullsoef2015.pdf

Montreal process on criteria and indicators for the conservation and sustainable management of temperate and boreal forests. 1995.Available at: https://www.montrealprocess.org/documents/publications/general/2009/2009p_4.pdf

MROSEK, T., BALSILLIE, D., and SCHLEIFENBAUM, P. 2006. Field testing of a criteria and indicators system for sustainable forest management at the local level. Case study results concerning the sustainability of the private forest Haliburton Forest and Wild Life Reserve in Ontario, Canada. *Forest Policy and Economics* **8**: 593– 609.

NATIONAL FOREST INVENTORY 2012. State of Finland's Forests. Available at: http://www.metla.fi/metinfo/sustainability/c3.htm

NEWSOM, D., BAHN, V. and CASHORE, B. 2006. Does forest certification matter? An analysis of operation-level changes required during the SmartWood certification process in the United States. *Forest Policy and Economics*, **9** Issue 3: 197-208, ISSN 1389-9341, https://doi.org/10.1016/j.forpol.2005.06.007.

NEPCON 2012. Comparative analysis of the PEFC system with FSCTM Controlled Wood requirements. Available at: http://www.fsc-uk.org/preview.comparative-analysis-of-the-pefc-system-with-fsc-controlled-wood-requirements.a-257.pdf

PACI, M. 2004. Problemi attuali della selvicoltura naturalistica. *Forest@* **1** (2): 59-69.

PALETTO, A., DE MEO, I., DI SALVATORE, U. and FERRETTI, F. 2014. Analisi percettiva della Gestione Forestale Sostenibile (GFS) attraverso l'impiego delle mappe cognitive. *Forest@* **11**: 125-137.

PALETTO, A., NOTARO, S., PASTORELLA, F., GIACOVELLI, G., GIOVANNELLI, S. and TURCO, R. 2017. Certificazione forestale in Calabria: attitudini, preferenze e disponibilità a pagare delle imprese di seconda trasformazione del legno. *Forest@* **14**:107-123. Available at: http://www.sisef.it/forest@/contents/?id=efor2174-014

PALETTO A. and NOTARO S. 2018. Secondary wood manufactures willingness-to-pay for certified wood products in Italy. *Forest Policy and Economics* **92**: 65-72. https://doi.org/10.1016/j.forpol.2018.04.002.

PEFC ITALIA 2017. *Standard PEFC Italia, ITA 1001-1, Criteri e indicatori per la certificazione individuale e di gruppo di GFS.* Available at: http://www.pefc.it

PEFC 2017. *PEFC Global Statistics: SFM & CoC Certification*.

PEFC ITALIA 2017 a. *Matrice di valutazione di certificazione del sistema di gestione forestale di un consorzio forestale.* Available at: http://www.pefc.it

PEFC ITALIA 2017 b. *Companies database*. Available at: http://pefc.start2000.net/aziende_online/ricerca.asp?pagina=1&aggregazione=1

PEFC ITALIA 2017 c. *Che vantaggi per chi si certifica?* Available at: http://www.pefc.it/gfs/vantaggigfs

PIZZUTO ANTINORO, M. and LA MELA VECA, D.S. 2014. *Gestione sostenibile delle foreste Mediterranee e uso energetico delle biomasse forestali residuali*. Palermo: Dipartimento Regionale dello Sviluppo Rurale e Territoriale, Regione Siciliana.

RAMETSTEINER, E. and SIMULA, M. 2003. Forest certification - an instrument to promote sustainable forest management? *Journal of Environmental Management* **67**: 87-98.

REGIONE SICILIANA, ASSESSORATO AGRICOLTURA E FORESTE 2006. *Prescrizioni di Massima e di Polizia Forestale per i boschi sottoposti a vincolo idrogeologico nella provincia di Agrigento.*

REGIONE SICILIANA, ASSESSORATO AGRICOLTURA E FORESTE 2006. *Prescrizioni di Massima e di Polizia Forestale per i boschi sottoposti a vincolo idrogeologico nella provincia di Palermo.*

REGIONE SICILIANA, ASSESSORATO REGIONALE DEL TERRITORIO E DELL'AMBIENTE 2017. *Aggiornamento del piano regionale per la programmazione delle attività di previsione, prevenzione e lotta attiva contro gli incendi boschivi.*

SANTOPUOLI, G., FERRANTI, F. and MARCHETTI, M. 2015. Implementing Criteria and Indicators for Sustainable Forest Management in a Decentralized Setting: Italy as a Case Study. *Journal of Environmental Policy & Planning.* **18** (2): 177-196, DOI: 10.1080/1523908X.2015.1065718

TIAN, N., NEELAN, C. and LU, F. 2018. Understanding landowners' interest and willingness to participate in forest certification program in China. *Land Use Policy* **71**: 271–280.

TRICALLOTIS, M., GUNNINGHAM, N., KANOWSKI, P. 2018. The impacts of forest certification for Chilean forestry businesses. *Forest Policy and Economics* **92**: 82-91.

TURCO, M., BEDIA J., DI LIBERTO F., FIORUCCI P., VON HARDENBERG J., KOUTSIAS N., *et al.* 2016. Decreasing Fires in Mediterranean Europe. *PLoS ONE* **11**(3): e0150663. doi:10.1371/journal. pone.0150663

VIZZARRI, A., SALLUSTIO, L., TRAVAGLINI, D., BOTTALICO, F., CHIRICI, G., GARFI', V., LAFORTEZZA, R., LA MELA VECA, D.S., LOMBARDI, F., MAETZKE, F.G., MARCHETTI, M. 2017. The MIMOSE Approach to Support Sustainable Forest Management Planning at Regional Scale in Mediterranean Contexts. *Sustainability* **9** (2), 316; doi:10.3390/su9020316

V.V.A.A. 2008. *Piano di Gestione Monti Madonie.* Available at: http://www.artasicilia.eu/old_site/web/natura2000/

V.V.A.A. 2010. *Piano di Gestione, Ambito territoriale dei "Monti Sicani".* Available at: http://www.artasicilia.eu/old_site/web/natura2000/

V.V. A.A. 2016), *Brevi lezioni di paesaggio.* Franco Angeli.

WANG, S. WILSON, B. 2007. Pluralism in the economics of sustainable forest management. *Forest Policy and Economics* **9** (7): 743–750.

(ANNEX I TABLE 1 *C&I of ITA 1001-1 standard with the informative source required)*

(ANNEX II *Questionnaire)*